SMPTE STANDARD

D-Cinema Packaging — Aux Data Track File

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Foreword

SMPTE (the Society of Motion Picture and Television Engineers) is an internationally-recognized standards developing organization. Headquartered and incorporated in the United States of America, SMPTE has members in over 80 countries on six continents. SMPTE's Engineering Documents, including Standards, Recommended Practices, and Engineering Guidelines, are prepared by SMPTE's Technology Committees. Participation in these Committees is open to all with a bona fide interest in their work. SMPTE cooperates closely with other standards-developing organizations, including ISO, IEC and ITU.

SMPTE Engineering Documents are drafted in accordance with the rules given in its Standards Operations Manual.

SMPTE ST 429-14 was prepared by Technology Committee 21DC.

Intellectual Property

At the time of publication no notice had been received by SMPTE claiming patent rights essential to the implementation of this Standard. However, attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. SMPTE shall not be held responsible for identifying any or all such patent rights.

Introduction

This section is entirely informative and does not form an integral part of this Engineering Document.

This document specifies a method for carrying data essence in the MXF Generic Container for use in a D-Cinema Package. This specification is intended to place minimal constraints on the type of data to be carried or how it is used. In order to decode data packaged using the specification, additional information will be needed. While the specification is written to allow synchronization of the data track with picture or sound, the synchronization mechanism is outside the scope of this document. The abbreviation "aux" is used in place of the word "auxiliary" throughout the document, but the terms are interchangeable. The term "aux" is preferred.

1 Scope

This standard specifies the mapping of unspecified data into the Data Element of the MXF Generic Container for use within a Digital Cinema Package. The MXF Generic Container (GC) is described in [SMPTE ST 379].

This standard specifies the Key, the Length and the Value fields of the Aux Data Element. This standard also defines the Essence Container and the Essence Descriptor.

This standard defines the [SMPTE ST 429-7] Composition Playlist asset type extension required for inclusion of an Aux Data track.

2 Conformance Notation

Normative text is text that describes elements of the design that are indispensable or contains the conformance language keywords: "shall", "should", or "may". Informative text is text that is potentially helpful to the user, but not indispensable, and can be removed, changed, or added editorially without affecting interoperability. Informative text does not contain any conformance keywords.

All text in this document is, by default, normative, except: the Introduction, any section explicitly labeled as "Informative" or individual paragraphs that start with "Note:"

The keywords "shall" and "shall not" indicate requirements strictly to be followed in order to conform to the document and from which no deviation is permitted.

The keywords, "should" and "should not" indicate that, among several possibilities, one is recommended as particularly suitable, without mentioning or excluding others; or that a certain course of action is preferred but not necessarily required; or that (in the negative form) a certain possibility or course of action is deprecated but not prohibited.

The keywords "may" and "need not" indicate courses of action permissible within the limits of the document.

The keyword “reserved” indicates a provision that is not defined at this time, shall not be used, and may be defined in the future. The keyword “forbidden” indicates “reserved” and in addition indicates that the provision will never be defined in the future.

A conformant implementation according to this document is one that includes all mandatory provisions ("shall") and, if implemented, all recommended provisions ("should") as described. A conformant implementation need not implement optional provisions ("may") and need not implement them as described.

Unless otherwise specified, the order of precedence of the types of normative information in this document shall be as follows: Normative prose shall be the authoritative definition; Tables shall be next; followed by formal languages; then figures; and then any other language forms.

3 Normative References

Note: All references in this document to other SMPTE documents use the current numbering style (e.g. SMPTE ST 377:2004) although, during a transitional phase, the document as published (printed or PDF) may bear an older designation (such as SMPTE 377M-2004). Documents with the same root number (e.g. 377) and publication year (e.g. 2004) are functionally identical.

The following standards contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent edition of the standards indicated below.

[SMPTE ST 377] SMPTE ST 377:2004[1], Television — Material Exchange Format (MXF) — File Format Specification

[SMPTE ST 379] SMPTE ST 379:2004, Television — Material Exchange Format (MXF) — MXF Generic Container

[SMPTE ST 400] SMPTE ST 400:2012, SMPTE Labels Structure

[SMPTE ST 429-3] SMPTE ST 429-3:2007, D-Cinema Packaging — Sound and Picture Track File

[SMPTE ST 429-7] SMPTE ST 429-7:2006, D-Cinema Packaging — Composition Play List

[SMPTE ST 2029] SMPTE ST 2029:2009, Uniform Resource Names for SMPTE Resources

[XML] World Wide Web Consortium (W3C) (2004 February 4). Extensible Markup Language (XML) 1.0 (Third Edition)

[XML Schema Part1: Structures] World Wide Web Consortium (W3C) (2004, October 28). XML Schema Part 1: Structures (Second Edition)

[XML Schema Part 2: Datatypes] World Wide Web Consortium (W3C) (2004, October 28). XML Schema Part 2: Datatypes (Second Edition)

[RFC 2396] Internet Engineering Task Force (IETF) (1996, November). RFC 2396 — Uniform Resource Identifiers (URI): Generic Syntax

4 Glossary of Acronyms, Terms and Data Types

The general glossary of acronyms, terms and data types used in the MXF specification is given in [SMPTE ST 377] and is supplemented in [SMPTE ST 379]. These glossaries are not repeated here to avoid any divergence of meaning.

The reader is also directed to the glossary terms defined in [SMPTE ST 429-7].

5 Carrying Data in the MXF Generic Container

5.1 Frame Wrapping

The "Frame Wrapping" method for data essence is illustrated in Figure 1. Frame wrapping shall be used for the Aux Data track file.

Figure 1 shows a series of data elements, each wrapped in a single Content Package Data Element with no other Generic Container Elements in the Container. Each Content Package has the duration of one edit unit.

[1]The reference to SMPTE ST 377:2004 and SMPTE ST 379:2004 are intentional. SMPTE ST 377-1:2011 and SMPTE ST 379-1:2009 or future versions are not appropriate for use with this document.

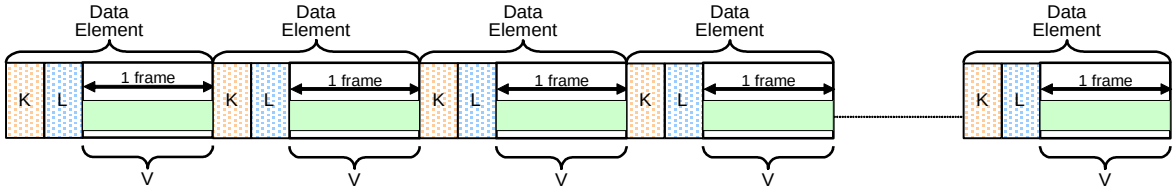

Figure 1 – Simple Representation of Frame Wrapping (Informative)

The Frame Wrapping method enables frame by frame access by MXF applications which process at the KLV level. Sufficient Information is provided to allow individual frames to be identified at the KLV level without an MXF decoder having to parse or decode the Essence Data. Each data frame shall be KLV wrapped using a GC Data Element Key.

5.2 Clip Wrapping

Clip wrapping shall not be used in an Aux Data track file.

5.3 Custom Wrapping

Custom wrapping shall not be used in an Aux Data track file.

5.4 Element and Item Constraints

Only Data Elements shall be carried in an Aux Data track file. Each Data Item shall contain only a single Data Element.

6 KLV Coding of Aux Data Elements

6.1 Data Element Key

The values of the first 12 bytes of the essence element key are defined in [SMPTE ST 379], Table 2. The other bytes are defined below:

Table 1 – Essence Key Bytes 13-16

Byte No.	Description	Value (hex)	Meaning
13	Item Type Identifier	17h	GC Data Item
14	Essence Element Count	Xx	Count of Data Elements in this Generic Container
15	Essence Element Type	0Dh	Aux Data Frame-wrapped Element
16	Essence Element Number	Yy	The number (used as an index) of this Data Element in this Generic Container

6.2 Length

The length field and its application shall comply with [SMPTE ST 377].

6.3 Value

6.3.1 Frame Wrapped

The value field shall comprise data intended to have a decoded duration of one edit unit. Data wrapped this way should be decodable as an individual edit unit.

7 Constraints

The Aux Data Track file shall be constrained to comply with [SMPTE ST 429-3], Sound and Picture Track file with respect to pattern, header metadata, and asset identity constraints.

8 Label for Aux Data Essence Container Identification

The value for the Essence Container UL shall be as given in Table 2.

Table 2 – Specification of the Essence Container Label

Byte No.	Description	Value (hex)	Meaning
1-12	Defined by Generic Container		
13	Essence Container Kind	02h	MXF Generic Container
14	Mapping Kind	13h	Aux Data
15	Content Kind	02h	Aux Data Frame-wrapped Element
16	Reserved	01h	

The Essence Container UL is used within a batch of ULs in Partition Packs and the Preface set and on its own in the Essence Descriptor. This UL value is listed in the SMPTE Label Registry.

9 Aux Data Essence Descriptor

The File Descriptor sets are those structural metadata sets in the Header Metadata that describe the essence and metadata elements defined in this document. The Aux Data Essence Descriptor shall be a sub-class of the Generic Data Essence Descriptor [SMPTE ST 377]. File Descriptor sets shall be present in the Header Metadata for each Essence Element. Implementations that carry specific data types may extend the Aux Data Essence Descriptor using a sub-descriptor. Implementations complying with this specification shall ignore unrecognized sub-descriptors.

Table 3 – Aux Data Essence Descriptor

Item Name	Type	Len	Local Tag	UL Designator	Req ?	Meaning	Default
Aux Data Essence Descriptor	Set UL	16	dyn	06.0E.2B.34.02.7F.01.01.0D.01.01.01.01.01.73.00	Req	Defines the Data Essence Descriptor Set (a collection of Parametric metadata)	
Length	BER Length	var			Req	Set length	
All items from the Generic Data Essence Descriptor in SMPTE ST 377 (File Format Specification Annex D.4) to be included. Data Essence Coding usage is modified as specified below.							

The DataEssenceCoding item shall be present in in the Aux Data Essence Descriptor.

All other items use the default value as specified in [SMPTE ST 377], Annex D.4.

10 Composition Playlist Extensions

10.1 Extension Elements

To reference the Auxiliary Data essence in a Composition, the extension elements defined in this section shall be used to extend the Reel element of a Composition Playlist, as specified in [SMPTE ST 429-7].

10.2 Namespace

The `AuxData` extension element defined in this specification shall be associated with a unique XML namespace name that shall be the string value "`http://www.smpte-ra.org/schemas/429-14/2014/Aux-Data`". This namespace name conveys both structural and semantic version information, and serves the purpose of a traditional version number field.

XML namespace names used in this standard are identified in Table 4. Namespace names are represented as Uniform Resource Identifier (URI) values [RFC 2396][2].

Table 4 – XML Namespaces

Qualifier	URI
cpl	`http://www.smpte-ra.org/schemas/429-7/2006/CPL`
axd	`http://www.smpte-ra.org/schemas/429-14/2014/Aux-Data`

URIs listed in Table 4 are normative, whereas the namespace qualifier values themselves (used in Table 4 and elsewhere in this standard) are not normative. Thus, namespace qualifier values may be replaced in instance documents by any arbitrary XML-compliant namespace qualifier, meaning that conformant implementations shall expect any XML-compliant namespace qualifier value that is associated with a URI from Datatypes from other schemas that are used in this document will be prefixed with the appropriate namespace qualifier (e.g. xs:`dateTime`). See [XMLSchema Part 2: Datatypes] for further information about these types.

[2] Readers unfamiliar with URI values as XML namespace names should be aware that although a URI value begins with a "scheme" element ("http" in this case), the value is designed primarily to be a unique string and does not necessarily correspond to an actual on-line resource. Applications implementing this standard should not attempt to resolve URI values on-line.

10.3 AuxData

The `AuxData` extension element defines the Auxiliary Data asset intended for use with the composition. The actual data essence is contained in an external Track File.

The `AuxData` element shall be an instance of the `DataTrackFileAssetType` element, which is derived from the `TrackFileAssetType` whose structure is defined in [SMPTE ST 429-7].

The element defined below replicate values contained in the underlying track file and shall remain consistent with the content of the underlying track file at all times. It is included in the Composition Playlist to alleviate the need for theater management software to access and parse individual track files when scheduling content. In the event an inconsistency exists, the values contained in the underlying track file shall take precedence.

10.3.1 DataEssenceCoding [optional]

The Data EssenceCoding element is a UL that matches the value of the Data Essence Coding parameter of the Aux Data Essence Descriptor (Section 9). This allows identification of the type of data essence that is referenced by the AuxData track. It shall be coded as type urn:smpte:ul as specified in [SMPTE ST 2029].

11 Schema

The XML Schema document presented in this section normatively defines the structure of the [SMPTE ST 429-7] Composition Playlist extension previously described using a machine-readable language. While this schema is intended to faithfully represent the structure presented in the normative prose portions of this specification, conflicts in definition may occur. In the event of such a conflict, the normative prose shall be the authoritative expression of the standard.

```
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema targetNamespace="http://www.smpte-ra.org/schemas/429-14/2014/Aux-Data"
      xmlns:xs="http://www.w3.org/2001/XMLSchema"
      xmlns:cpl="http://www.smpte-ra.org/schemas/429-7/2006/CPL"
      xmlns:axd="http://www.smpte-ra.org/schemas/429-14/2014/Aux-Data"
      elementFormDefault="qualified" attributeFormDefault="unqualified">
  <xs:import namespace="http://www.smpte-ra.org/schemas/429-7/2006/CPL"/>
  <xs:element name="AuxData" type="axd:DataTrackFileAssetType" />
  <xs:complexType name="DataTrackFileAssetType">
    <xs:complexContent>
        <xs:extension base="cpl:TrackFileAssetType">
        <xs:sequence>
          <xs:element name="DataEssenceCoding" type="xs:anyURI" minOccurs="0"/>
          <xs:any namespace="##other" minOccurs="0" maxOccurs="unbounded"
                  processContents="lax" />
        </xs:sequence>
      </xs:extension>
    </xs:complexContent>
  </xs:complexType>
</xs:schema>
```

12 Sample (Informative)

A Composition Playlist (CPL) Reel sample is provided below to illustrate implementation of the extension element defined in this specification.

Aux Data CPL Reel Sample

```
<?xml version="1.0" encoding="UTF-8" standalone="no" ?>
<cpl:CompositionPlaylist xmlns:cpl="http://www.smpte-ra.org/schemas/429-7/2006/CPL">
  <cpl:Id>urn:uuid:55c74f73-2b20-458d-9d05-389ec7f8bc3d</cpl:Id>
  <cpl:IssueDate>2012-06-01T17:44:36+00:00</cpl:IssueDate>
  <cpl:ContentTitleText>Example Aux Data CPL</cpl:ContentTitleText>
  <cpl:ContentKind>test</cpl:ContentKind>
  <cpl:ContentVersion>
    <cpl:Id>urn:uuid:07254436-5254-45ae-8ac3-5e380135b7f5</cpl:Id>
    <cpl:LabelText></cpl:LabelText>
  </cpl:ContentVersion>
  <cpl:RatingList/>
  <cpl:ReelList>
    <cpl:Reel>
      <cpl:Id>urn:uuid:117120ab-07eb-4a26-8356-ce28e7b4a8cf</cpl:Id>
      <cpl:AnnotationText>Reel #1 of The Jazz Singer</cpl:AnnotationText>
      <cpl:AssetList>
        <cpl:MainPicture>
          <cpl:Id>urn:uuid:8a212f2b-e753-4161-a115-733c3b15f62d</cpl:Id>
          <cpl:AnnotationText>Picture for Reel #1 of The Jazz Singer</cpl:AnnotationText>
          <cpl:EditRate>24 1</cpl:EditRate>
          <cpl:IntrinsicDuration>3800</cpl:IntrinsicDuration>
          <cpl:EntryPoint>100</cpl:EntryPoint>
          <cpl:Duration>3600</cpl:Duration>
          <cpl:KeyId>urn:uuid:7f70a22d-489a-4272-8697-bb649f9f35d8</cpl:KeyId>
          <cpl:FrameRate>24 1</cpl:FrameRate>
          <cpl:ScreenAspectRatio>185 100</cpl:ScreenAspectRatio>
        </cpl:MainPicture>
        <cpl:MainSound>
          <cpl:Id>urn:uuid:d9ba0fb8-40c4-40db-93e3-3d6189904223</cpl:Id>
          <cpl:AnnotationText>Soundtrack for Reel #1 of The Jazz Singer</cpl:AnnotationText>
          <cpl:EditRate>24 1</cpl:EditRate>
          <cpl:IntrinsicDuration>3600</cpl:IntrinsicDuration>
          <cpl:KeyId>urn:uuid:942a31d1-71bc-4272-9a52-cc376859e367</cpl:KeyId>
          <cpl:Language>en-us</cpl:Language>
        </cpl:MainSound>
        <axd:AuxData xmlns:axd="http://www.smpte-ra.org/schemas/429-14/2014/Aux-Data ">
          <cpl:Id>urn:uuid:92840e55-2c8d-4c84-a688-91a61e602193</cpl:Id>
          <cpl:AnnotationText>Special Data Track</cpl:AnnotationText>
          <cpl:EditRate>24 1</cpl:EditRate>
          <cpl:IntrinsicDuration>3700</cpl:IntrinsicDuration>
          <cpl:EntryPoint>100</cpl:EntryPoint>
          <axd:DataEssenceCoding>urn:smpte:ul:060E2B34.04010105.01020304.00000000
               </axd:DataEssenceCoding>
        </axd:AuxData>
      </cpl:AssetList>
    </cpl:Reel>
  </cpl:ReelList>
</cpl:CompositionPlaylist>
```

Annex A Bibliography (Informative)

Note: All references in this document to other SMPTE documents use the current numbering style (e.g. SMPTE ST 298:2009) although, during a transitional phase, the document as published (printed or PDF) may bear an older designation (such as SMPTE 298-2009). Documents with the same root number (e.g. 298) and publication year (e.g. 2009) are functionally identical.

SMPTE ST 298:2009, Universal Labels for Unique Identification of Digital Data.

SMPTE ST 336:2007, Data Coding Protocol Using Key-Length-Value.